

WHAT IS CLAIMED IS:

1. BaTiO₃ - PbTiO₃ series single crystal single-crystallized by heating BaTiO₃ - PbTiO₃ compact powder member or sintered member having a smaller Pb-containing mol number than Ba-containing mol number,
5 while keeping said powder or member in non-molten condition.

10 2. BaTiO₃ - PbTiO₃ series single crystal according to Claim 1, wherein the rearrangement density is 10² pieces/cm² or more and 10⁶ pieces/cm² or less, and the ratio of pore content is within a range of 1 volume ppm or more and 5 volume % or less.

15 3. BaTiO₃ - PbTiO₃ series single crystal according to Claim 1, wherein the ratio of PbTiO₃ content is 45 mol % or less.

20 4. BaTiO₃ - PbTiO₃ series single crystal according to Claim 3, wherein the ratio of PbTiO₃ content is 30 mol % or less.

25 5. BaTiO₃ - PbTiO₃ series single crystal according to Claim 4, wherein the ratio of PbTiO₃ content is 25 mol % or less.

6. BaTiO₃ - PbTiO₃ series single crystal according

to Claim 1, wherein the volume of said single crystal
is 1 mm³ or more.

7. A piezoelectric type actuator comprising:
5 a layer formed by BaTiO₃ - PbTiO₃ series single
crystal according to Claim 1.

8. A liquid discharge head comprising:
10 the piezoelectric type actuator according to Claim
7.

9. BaTiO₃ - PbTiO₃ series single crystal having
the rearrangement density of 10² pieces/cm² or more and
15 10⁶ pieces/cm² or less, and the ratio of pore content
being within in a range of 1 volume ppm or more and 5
volume % or less.

10. BaTiO₃ - PbTiO₃ series single crystal
according to Claim 9, wherein the ratio of PbTiO₃
20 content is 45 mol % or less.

11. A piezoelectric type actuator comprising:
a layer formed by BaTiO₃ - PbTiO₃ series single
crystal according to Claim 9.

25
12. A liquid discharge head comprising:
the piezoelectric type actuator according to Claim

11.

13. A method for manufacturing BaTiO₃ - PbTiO₃,
5 series single crystal comprising the following step of:
single-crystallizing BaTiO₃ - PbTiO₃ compact powder
member or sintered member having a smaller Pb-
containing mol number than Ba-containing mol number by
defining the range of the mol ratio of elements
10 contained therein to be $0.9800 < (\text{Ba} + \text{Pb}) / \text{Ti} < 1.0000$, and by heating, while keeping said powder or
member in non-molten condition.

14. A method for manufacturing BaTiO₃ - PbTiO₃,
15 series single crystal according to Claim 13, wherein
the range of the mol ratio of elements contained in
said compact powder member or sintered member to be
 $0.9900 < (\text{Ba} + \text{Pb}) / \text{Ti} < 0.9999$.

20 15. A method for manufacturing BaTiO₃ - PbTiO₃,
series single crystal according to Claim 14, wherein
the range of the mol ratio of elements contained in
said compact powder member or sintered member to be
 $0.9950 \leq (\text{Ba} + \text{Pb}) / \text{Ti} \leq 1.0000$.

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16. A method for manufacturing BaTiO₃ - PbTiO₃,
series single crystal according to Claim 13, wherein

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the ratio of PbTiO₃ content in said compact powder member or said sintered member is 45 mol % or less.

5 17. A method for manufacturing BaTiO₃ - PbTiO₃ series single crystal according to Claim 16, wherein the ratio of PbTiO₃ content in said compact powder member or said sintered member is 30 mol % or less.

10 18. A method for manufacturing BaTiO₃ - PbTiO₃ series single crystal according to Claim 17, wherein the ratio of PbTiO₃ content in said compact powder member or said sintered member is 25 mol % or less.

15 19. A method for manufacturing BaTiO₃ - PbTiO₃ series single crystal according to Claim 13, comprising the following step of:

20 single-crystallizing by heating said compact powder member or sintered member within a temperature range of 1,200°C or more and 1,400°C or less.

25 20. A method for manufacturing BaTiO₃ - PbTiO₃ series single crystal according to Claim 13, wherein a compound containing lead is inserted into a furnace during the single crystal growing process to generate steam containing Pb for the growth of BaTiO₃ - PbTiO₃ series single crystal.

21. A method for manufacturing BaTiO₃ - PbTiO₃ series single crystal according to Claim 13, comprising the following step of:

single-crystallizing by heating, while keeping
5 said compact powder member or sintered member in the lead atmosphere and in non-molten condition.

22. A method for manufacturing BaTiO₃ - PbTiO₃ series single crystal, comprising the following steps
10 of:

preparing BaTiO₃ series single crystal or BaTiO₃ - PbTiO₃ series single crystal as seed crystal;

coupling BaTiO₃ - PbTiO₃ series sintered member composed of crystal grain of average granular diameter
15 of 20 µm or less, having the relative density of 95% or more, with the {100} plane, {110} plane, or {111} plane of said seed crystal; and

single-crystallizing by heating, while keeping
said coupled substance in non-molten condition.

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23. A method for manufacturing BaTiO₃ - PbTiO₃ series single crystal according to Claim 20, wherein the mol ratio of elements contained in said BaTiO₃ - PbTiO₃ series sintered member is within a range of
25 0.9950 ≤ (Ba + Pb) / Ti ≤ 0.9999.

24. A method for manufacturing BaTiO₃ - PbTiO₃

series single crystal according to Claim 22, wherein a compound containing lead is inserted into a furnace during the single crystal growing process to generate steam containing Pb for the growth of BaTiO₃ - PbTiO₃

5 series single crystal.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100